CONTENTS

Foreword ix

PHYSICAL BASIS FOR THE UTILIZATION OF DIFFERENT SPECTROSCOPIES

The dielectric description of inelastic electron scattering
P. Schattschneider 1

Inner-shell spectroscopy: an atomic view
P. Rez 16

Cross sections for inelastic electron scattering in solids
C.J. Powell 24

High resolution energy-loss spectroscopy
P.E. Batson 32

Dielectric theory of localised valence energy loss spectroscopy
M.G. Walls and A. Howie 40

Applications of the near-edge and low-loss fine structure in the analysis of diamond
S.D. Berger, J. Bruley, L.M. Brown and D.R. McKenzie 43

Coherence effects in plasmon excitation
P. Schattschneider and D.-S. Su 47

Quantification of white lines in electron energy loss spectroscopy (EELS)
T. Manoubi, M. Tencé and C. Colliex 49

Current problems in X-ray emission spectroscopy
J.I. Goldstein, D.B. Williams and C.E. Lyman 56

Study and applications of channeled-electron-induced localized X-ray emission
F. Glas 61

Local structural investigation of surfaces and interfaces by EELFS and EXFAS techniques
M. De Crescenzi 65

Summaries

Theoretical analysis of inelastic electron scattering
J. Sevely 72

Problems in electron energy loss spectroscopy
R. Leapman 74

Problems in X-ray emission spectroscopy
J.N. Chapman 76

Problems in electron emission spectroscopy
M. De Crescenzi 79

INSTRUMENTATION

The evolution of the analytical electron microscope
K.D. van der Mast 81
Survey of electron sources for high-resolution microscopy
J. Orloff 88
Magnetic field emission gun with zirconiated emitter: performances at low voltage
M. Troyon 98
Field emission gun for surface studies
P. Morin, Lei He Ning and F. Pellerin 103
Electron detection in the analytical electron microscope
J.N. Chapman, A.J. Craven and C.P. Scott 108
Improved parallel-detection electron-energy-loss spectrometer
O.L. Krivanek 118
Parallel recording for an electron spectrometer on a scanning transmission electron microscope
S.D. Berger and D. McMullan 122
A quadrupole lens system for use in a parallel recording system for electron energy loss spectroscopy
C.P. Scott and A.J. Craven 126
Two-dimensional CCD arrays as parallel detectors in electron-energy-loss and X-ray wavelength-dispersive spectroscopy
N.J. Zaluzec and M.G. Strauss 131
X-ray detectors and spectrometers
C.E. Lyman, D.B. Williams and J.I. Goldstein 137
Problems associated with EDX detectors from a manufacturer's point of view
B.G. Lowe 150
The effect of magnetic fields on incomplete charge collection in Si(Li) X-ray detectors
A.J. Craven, C.P. McHardy and K.A. Pears 157
The wavelength-dispersive spectrometer and its proposed use in the analytical electron microscope
J.I. Goldstein, C.E. Lyman and D.B. Williams 162
Electron-energy-loss-based spectroscopies: a molecular viewpoint
A.P. Hitchcock 165
Optimization of imaging energy filters for high-resolution analytical electron microscopy
H. Rose 184
A corrected double-deflection electron spectrometer equipped with a parallel recording system
M. Haider 190
Design of a high-performance Auger spectrometer for the STEM
Feng Ouyang and M. Isaacson 201

Summaries

Consideration of electron optics for transmission, reflection and emission geometries
B. Jouffrey 205
Electron sources
M. Troyon 207

One- and two-dimensional electron detectors
J.A. Eades 209
X-ray detectors
J. Bentley 211
Spectroscopy techniques
O.L. Krivanek 213

DATA PROCESSING

Quantitative analysis of electron-energy-loss spectra
R.F. Egerton 215
Processing and quantification of X-ray energy-dispersive spectra in the analytical electron microscope
N.J. Zaluzec 226
Measurement of grain-boundary segregation by STEM–EDX analysis
I.A. Vatter and J.M. Titchmarsh 236
Filtered dark-field and pure *Z*-contrast: two novel imaging modes in a scanning transmission electron microscope
M. Haider 240
Chemical mapping and multivariate statistical analysis (prospect)
N. Bonnet and P. Hannequin 248
Spectrum-image: the next step in EELS digital acquisition and processing
C. Jeanguillaume and C. Colliex 252
Imaging and recording of multiple scattering effects by angular-resolved electron energy-loss spectroscopy
L. Reimer and R. Rennekamp 258
From experiment to interpretation: confidence limits
P. Trebbia and T. Manoubi 266
On the effect of objective lens chromatic aberration on quantitative electron-energy-loss spectroscopy (EELS)
J.M. Titchmarsh and T.F. Malis 277
EMMPDL – An Electron Microscopy and Microanalysis Public Domain Library
N.J. Zaluzec 283

Summaries

Spectral processing for EELS, Auger and X-ray spectroscopies
H. Shuman 288
Image processing
A. Engel 290
Evaluation of errors and accuracy of quantitative measurements
A.J. Craven 292

EXPERIMENTAL LIMITS

Specimen limitations in nanocharacterization by TEM/STEM of industrial heterogeneous catalysts: in situ, irradiation damage and micro/macro correlations
R. Szymanski and J. Lynch 295
Medium-voltage EDX and EELS
M.H. Loretto 302
Analytical microscopy problems specific to highly divided solids
P. Gallezot and C. Leclercq 308
Electron spectroscopic imaging of frozen-hydrated sections
W. Probst, E. Zellmann and R. Bauer 312
Multivariate statistical analysis of electron probe microanalytical data on cell nuclear constituents
C. Quintana and A. Ollacarizqueta 315
Limits of detection sensitivity due to electron beam radiation damage
M.S. Isaacson 320
Nanolithography using field emission and conventional thermionic electron sources
R.W. Devenish, D.J. Eaglesham, D.M. Maher and C.J. Humphreys 324
Analysis of small vanadium carbide precipitates using electron energy loss spectroscopy
A.J. Craven, M.M. Cluckie, S.P. Duckworth and T.N. Baker 330
Atomic sputtering in the analytical electron microscope
C.R. Bradley and N.M. Zaluzec 335
Elemental analysis near the single-atom detection level by processing sequences of energy-filtered images
C. Mory and C. Colliex 339
Comparison of high spatial resolution in EDX and EELS analysis
J.M. Titchmarsh 347

Summaries

Specimen considerations, materials science
J.M. Titchmarsh 352
Specimen considerations, biological science
J.P. Revel 355
Radiations effects
C.J. Humphreys 357
Definition of ultimate attainable spatial resolution
M. Scheinfein 359
Comparison with different existing techniques and suggestions for new methods
H. Poppa 361

Summary and conclusions
M. Isaacson and C. Colliex 363

Author index 369

Subject index 372